SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F-21-R-40

Name: Beaver Lake **County**: Minnehaha
Legal Description: T102N-R52W-Sec.14-15
Location from nearest town: 1 mile south and ¾ miles east of Humboldt, SD

Dates of present survey: June 25-27, 2007
Dates of last survey: June 25-27, 2006

Primary Game Species	Secondary and Other Species
Black Crappie	Black Bullhead
Walleye	Common Carp
Yellow Perch	Green Sunfish
	Northern Pike

PHYSICAL DATA

Surface Area: 306 acres **Watershed area**: No data available
Maximum depth: 10 feet **Mean depth**: 8 feet
Volume: No data available **Shoreline length**: No data available
Contour map available: Yes **Date mapped**: 1987
OHWM elevation: 1651.6 **Date set**: December, 1988
Outlet elevation: 1651.7 **Date set**: December, 1988
Lake elevation observed during the survey: 6 inches low
Beneficial use classifications: (6) warmwater marginal fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation.

Introduction

Beaver Lake is a shallow, natural lake located just southeast of Humboldt in west central Minnehaha County. A small, local watershed provides water inputs and overflows exit on the east end. Located relatively close to Sioux Falls, the lake is an important source of water-based recreation for the area.

Ownership of Lake and Adjacent Lakeshore Properties

Beaver Lake is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes. The South Dakota Department of Game, Fish, and Parks (GFP) owns and manages a small lake access area on the southwest corner of the lake. The remaining lakeshore is privately owned.

Fishing Access

The southwest lake access area features a concrete boat ramp, boat dock and vault toilet. Shoreline access is limited to the southwest road right-of-way, especially when the lake is full.

Field Observations of Water Quality and Aquatic Vegetation

The Secchi depth measurement was 25 cm (10 in) during the survey. Scattered beds of sago pondweed (*Potamogeton pectinatus*) were found around the entire lake while common cattail (*Typha spp.*) and river bulrush (*Scirpus fluviatilis*) were common in bays and shallow areas. Purple loosestrife (*Lythrum salicaria*) was found on the island and along the south and west shorelines.

BIOLOGICAL DATA

Methods:

Beaver Lake was sampled on June 25-27, 2007 with three overnight gill-net sets and 10 overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh (¾ in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh (½, ¾, 1, 1¼, 1½, and 2 in) monofilament netting. Sampling locations are displayed in Figure 3.

Results and Discussion:

Gill Net Catch

Black bullheads (64.9%), common carp (17.5%) and walleye (16.5%) were the most common species sampled in the gill nets (Table 1). Other species sampled included one yellow perch.

Table 1. Total catch from three overnight gill net sets at Beaver Lake, Minnehaha County, June 25-27, 2007.

Species	Number	Percent	CPUE[1]	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	63	64.9	21.0	±13.1	51.5	0	0	85
Common Carp	17	17.5	5.7	±2.6	15.8	94	0	84
Walleye	16	16.5	5.3	±2.4	3.4	0	0	90
Yellow Perch	1	1.0	0.3	±0.4	2.7	--	--	--

* 6 years (1999, 2001, 2003-2006)

[1] See Appendix A for definitions of CPUE, PSD, RSD-P, and mean Wr.

Trap Net Catch

Black bullheads (72.2%) and black crappies (14.8%) were the most abundant species in the trap-net catch (Table 2). Other species included green sunfish, walleye, common carp, yellow perch, hybrid sunfish, and northern pike.

Table 2. Total catch from ten overnight trap net sets at Beaver Lake, Minnehaha County, June 25-27, 2007.

Species	Number	%	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	1,904	72.2	190.4	±39.7	425.8	0	0	84
Black Crappie	389	14.8	38.9	±14.1	118.4	94	1	103
Green Sunfish	224	8.5	22.4	±14.9	7.1	2	0	110
Walleye	68	2.6	6.8	±2.4	2.1	0	0	86
Common Carp	44	1.7	4.4	±1.7	7.7	92	5	84
Yellow Perch	4	0.2	0.4	±0.3	0.8	--	--	--
Hybrid Sunfish	2	0.1	0.2	±0.2	0.0	--	--	--
Northern Pike	1	0.0	0.1	±0.1	0.3	--	--	--

* 6 years (1999, 2001, 2003-2006)

Walleye

Management objective: Establish and maintain a walleye population with a gill net CPUE of at least 20.

Walleye gill net CPUE remains far below our objective (Table 1) despite considerable efforts to increase it by stocking and special regulations. Since 2003, 300,000 walleye fry, 58,650 small fingerlings, 19,962 large fingerlings and 2,166 older have been stocked with little apparent success (Table 11). However, because walleye catch rates were high this year (Table 10), we suspect our gill nets may not be effectively sampling the population. Since spawning walleyes are easily captured with trap nets, we are planning to use them in spring 2008 to test this theory.

Gill-net caught walleyes ranged in length from 220 mm (9 in) to 275 mm (10.8 in) while trap-net caught fish were 210 mm (8.5 in) to 340 mm (13.4 in). No fish over 38 cm (15 in) fish were sampled.

Table 3. Walleye gill-net CPUE, PSD, and mean Wr for Beaver Lake, Minnehaha County, 1998-2007. Trap net data used for 2004 and 2005.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean*
CPUE		4.0		6.3		6.7	5.4	5.0	0.3	5.3	4.6
PSD		25		79		94	74	90	--	0	72
RSD-P		17		21		0	13	49	--	0	20
Mean Wr		93		102		102	81	84	--	90	92

*5 years (1999, 2001, 2003-2006)

Black Crappie

Management objective: Maintain a black crappie population with a trap net CPUE of at least 25 and a PSD of at least 40.

A large year class of black crappies was naturally-produced in 2001 (Tables 5 and 6). These fish are currently 19-25 cm (7.5-9.8 inches) long (Figure 1) and providing good fishing opportunities. Because this year class was so large, growth is considerably slower than statewide, regional, and large lake means (Table 6 and Figure 1). Historically, growth has been much better at lower densities. For example, in 1999, age-4 crappies averaged 259 mm (10.2 inches) but in 2006, age-6 fish were only 250 mm (9.8 inches) (Table 6). There has been little recruitment since 2001 (Figure 1).

Table 5. Black crappie trap-net CPUE, PSD, RSD-P, and mean Wr for Beaver Lake, Minnehaha County, 1999-2007.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	Avg.
CPUE	34.7		1.4		117.6	243.6	245.3	67.6	38.9	118.4
PSD	92		64		5	3	1	72	94	40
RSD-P	48		14		1	0	0	0	1	11
Mean Wr	104		101		108	95	103	99	103	102

*6 years (1999, 2001, 2003-2006)

Table 6. Average back-calculated lengths (mm) for each age class of black crappie in Beaver Lake, Minnehaha County, 2007.

			Back-calculation Age							
Year Class	Age	N	1	2	3	4	5	6	7	8
2006	1	4	86							
2005	2	2	76	157						
2004	3	4	100	184	213					
2003	4	24	82	141	175	198				
2002	5	4	75	135	169	184	196			
2001	6	351	77	133	167	182	200	213		
All Classes		**389**	**83**	**150**	**181**	**188**	**198**	**213**		
Statewide Mean			83	147	195	229	249			
Region III Mean			95	167	219	253	274			
LLI* Mean			89	161	210	247	271			

*Large Lakes and Impoundments (>150 acres)

Black Bullhead

Management objective: Maintain a bullhead population with a trap net CPUE of 100 or less.

Beaver Lake has a high-density black bullhead population (Table 7) with few fish longer than 20 cm (8 in) (Figure 2). Figure 2 also suggests a single, slow-growing year class where mean length only increased 45 mm (1.8 in) from 2004-2007. High bullhead abundance can be detrimental to water quality and habitat and the competition for food can affect the growth and recruitment of other fish species. Our attempt to reduce bullhead abundance by increasing walleye density may be responsible for declining

abundance (Table 7). However, low bullhead recruitment has been observed in other waters across the region so natural factors could be responsible as well.

Table 7. Black bullhead trap-net CPUE, PSD, RSD-P, and mean Wr for Beaver Lake, Minnehaha County, 1999-2007.

	1999	2001	2002	2003	2004	2005	2006	2007	Mean*
CPUE	238.5	91.9		300.8	1,105	423.1	395.2	190.4	425.8
PSD	83	48		50	0	0	0	0	30
RSD-P	0	0		3	0	0	0	0	1
Mean Wr	88	98		86	83	96	77	84	88
Mean Length mm		233		169	149	157	187	194	182

*6 years (1999, 2001, 2003-2006)

All Species

Common carp abundance has decreased slightly since 2004 (Table 9) while yellow perch abundance remains stable.

Table 8. Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in Beaver Lake, Minnehaha County, 1998-2007.

Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
COC (GN)		--		1.0		23.0	28.0	27.8	14.7	5.7
COC (TN)		--		0.6		31.1	10.3	2.8	1.2	4.4
WHS (GN)		--		--		--	--	--	--	--
WHS (TN)		--		--		--	0.5	--	--	--
BLB (GN)		114.3		45.7		42.0	30.0	21.0	55.7	21.0
BLB (TN)		238.5		91.9		300.8	1,105.0	423.1	395.2	190.4
NOP (GN)		--		--		1.7	--	0.3	--	--
NOP (TN)		--		0.1		0.2	0.7	0.6	0.1	0.1
GSF (GN)		0.3		--		--	--	--	--	--
GSF (TN)		41.4		--		0.1	0.7	0.4	--	22.4
OSF (GN)		--		--		--	--	--	--	--
OSF (TN)		--		--		--	0.1	0.1	0.6	--
HYB (GN)		--		--		--	--	--	--	--
HYB (TN)		--		--		--	--	--	--	0.2
BLC (GN)		50.0		0.3		26.7	8.5	7.3	2.0	--
BLC (TN)		34.7		1.4		117.6	243.6	245.3	67.6	38.9
YEP (GN)		0.7		11.7		1.0	0.5	1.8	0.7	0.3
YEP (TN)		0.1		1.5		1.6	1.0	0.2	0.1	0.4
WAE (GN)		4.0		6.3		6.7	1.5	1.3	0.4	5.3
WAE (TN)		0.3		0.3		1.2	5.4	5.0	0.1	6.8

COC (Common Carp), WHS (White Sucker), BLB (Black Bullhead), NOP (Northern Pike), GSF (Green Sunfish), OSF (Orangespotted Sunfish), HYB (Hybrid Sunfish), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye)

Creel Survey Results

A creel survey was conducted on Beaver Lake from May through August 2004-2007 to obtain baseline data on marginal lakes and to monitor the effects of a one walleye over 24 inch regulation. Fishing pressure declined to 4,245 hours (Table 9) (13.9 hours per acre) during the summer of 2007. Most of the pressure (57%) occurred on weekdays and only 34.6% was from boat anglers, despite improved boating access facilities. The average trip length was 2.36 hours. Of the parties interviewed, 16.8% were primarily targeting walleyes, 43.4% were targeting black crappies and 0.9% were targeting bullheads. All of the parties interviewed were South Dakota residents.

Catch rates for walleye and black crappie were good (Table 10), especially in May, and two-thirds of the black crappies caught were harvested. Anglers caught an estimated 3,912 walleyes, but none were harvested due to the special regulation. Anglers also caught an estimated 6,497 bullheads, but few were large enough to harvest (Table 9).

Table 9. Total estimates of fishing pressure and catch (harvest) of fish in Beaver Lake from May through August 2004 through 2007.

	Fishing Pressure (Hours)	Walleye Catch (Harvest)	Common Carp Catch (Harvest)	Black Bullhead Catch (Harvest)	Black Crappie Catch (Harvest)
2004	2,586	2,725 (19)	435 (85)	10,047 (669)	827 (51)
2005	9,110	5,978 (0)	166 (0)	21,927 (451)	6,674 (1,458)
2006	5,186	1,346 (0)	40 (20)	13,997 (1,943)	12,076 (8,583)
2007	4,245	3,912 (0)	86 (0)	6,497 (146)	2,695 (1,792)

Table 10. Total number of angler interviews and estimates of hourly catch rate (harvest rate) of fish in Beaver Lake from May through August 2004 through 2007.

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	Number of Interviews	Walleye Catch (Harvest)	Common Carp Catch (Harvest)	Black Bullhead Catch (Harvest)	Black Crappie Catch (Harvest)
2004	70	1.05 (0.007)	0.17 (0.03)	3.88 (0.26)	0.32 (0.02)
2005	211	0.66 (0.0)	0.02 (0.0)	2.41 (0.05)	0.73 (0.16)
2006	139	0.26 (0.0)	0.008 (0.004)	2.70 (0.37)	2.33 (1.66)
2007	112	0.92 (0.0)	0.02 (0.0)	1.53 (0.03)	0.63 (0.42)

MANAGEMENT RECOMMENDATIONS

1. Evaluate the effectiveness of the one walleye over 24 inches regulation based on information collected over the last 5 years. Attempt to sample walleyes in spring 2008 to determine if low summer gill net catches are accurately representing walleye abundance.

Table 11. Stocking record for Beaver Lake, Minnehaha County, 1998-2007.

Year	Number	Species	Size
1998	33,000	Walleye	Fingerling
	133	Walleye	Large Fingerling
	73	Walleye	Adult
1999	30,000	Walleye	Fingerling
2002	28,400	Walleye	Fingerling
2003	300,000	Walleye	Fry
	3,056	Walleye	Large Fingerling
	5,412	Yellow Perch	Fingerling
2004	126	Walleye	Juvenile
	1,730	Walleye	Adult
2005	20,460	Fathead Minnow	Adult
	10,240	Walleye	Large Fingerling
2006	30,250	Walleye	Fingerling
	6,666	Walleye	Large Fingerling
	310	Walleye	Juvenile
	24,700	Fathead Minnow	Adult
2007	825	Walleye	Large Fingerling

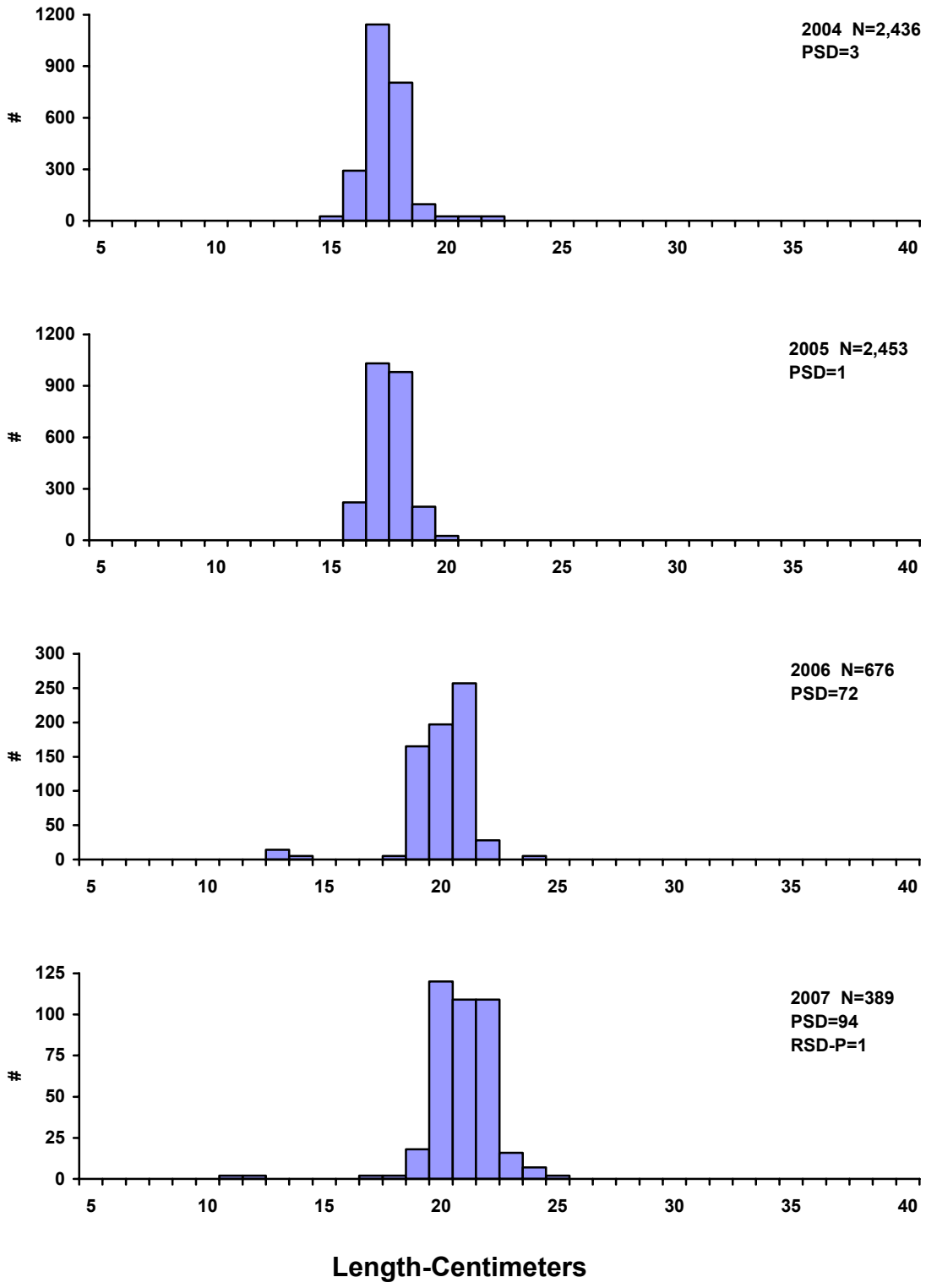

Figure 1. Length frequency histograms for black crappie sampled with trap nets in Beaver Lake, Minnehaha County, 2004, 2005, 2006 and 2007.

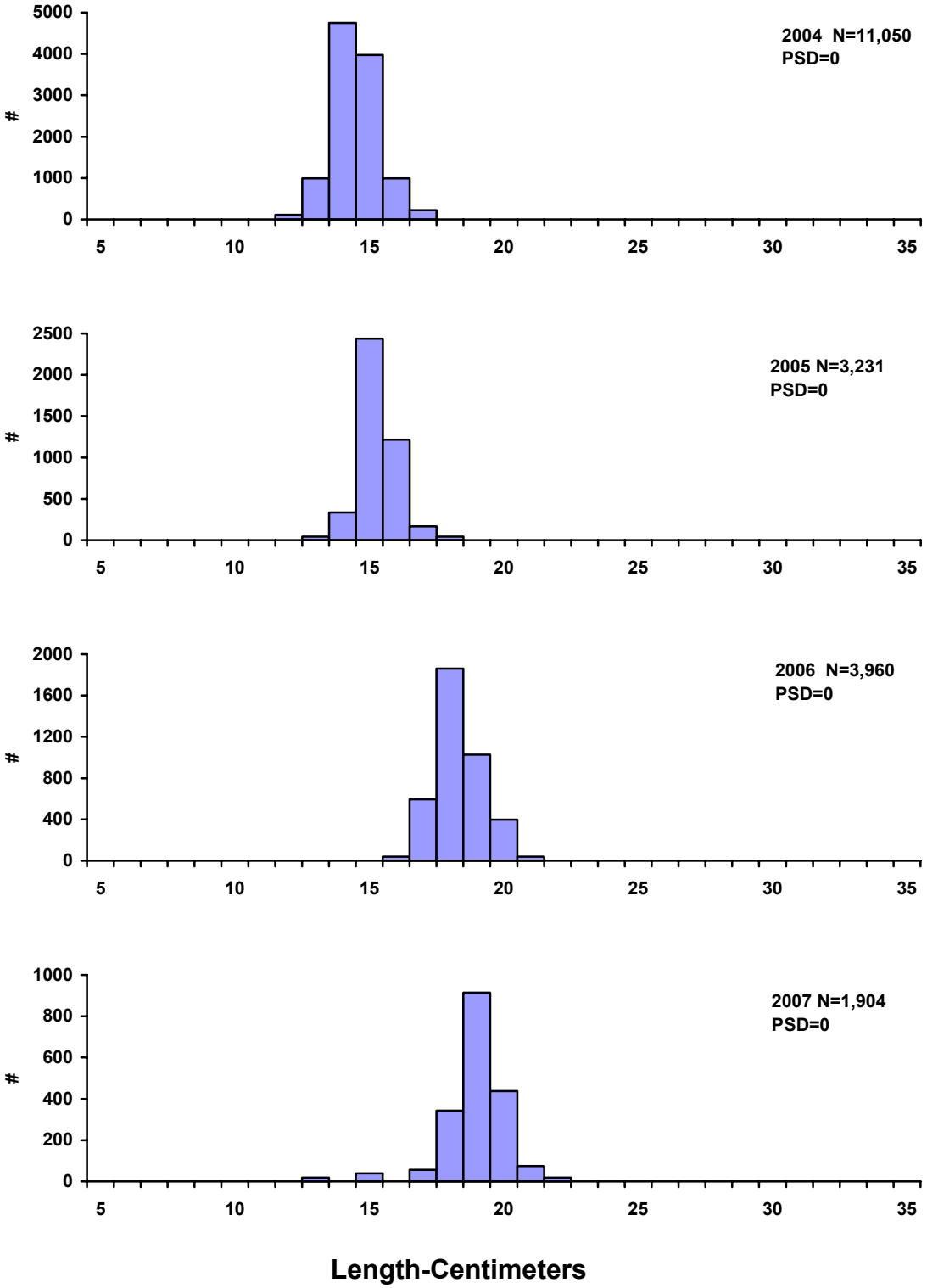

Figure 2. Length frequency histograms for black bullheads sampled with trap nets in Beaver Lake, Minnehaha County, 2004, 2005, 2006, and 2007.

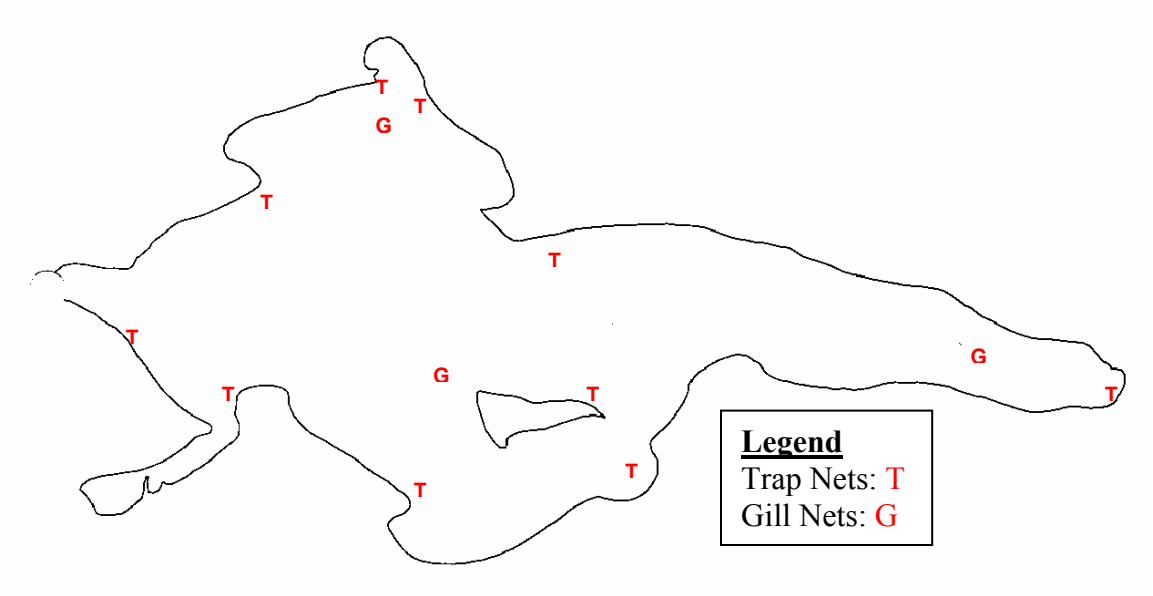

Figure 3. Sampling locations on Beaver Lake, Minnehaha County, 2007.

Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch Per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$PSD = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$RSD\text{-}P = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Black crappie	13	20	25	30	38
White crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
Northern pike	35	53	71	86	112
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Common carp	28	41	53	66	84
Bigmouth buffalo	28	41	53	66	84
Smallmouth buffalo	28	41	53	66	84

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.